



PATENT
Attorney Docket No. 440566

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Leonard E. BENSCH et al.

International Application
No. PCT/US00/25092

Filed: September 14, 2000

For: METHODS AND SYSTEMS FOR
COUNTING PARTICLES AND
SENSING WATER

Art Unit: Unassigned

Examiner: Unassigned

PENDING CLAIMS AFTER ENTRY OF PRELIMINARY AMENDMENT

1. A system for sampling a non-aqueous liquid comprising:
a water sensor capable of being coupled to a non-aqueous liquid to sense an indication of the water content of the non-aqueous liquid; and
an optical particle counter capable of being coupled to the non-aqueous liquid to provide an indication of the number of particulates present in the non-aqueous liquid.
2. The system of claim 1 wherein the water sensor and the optical particle counter are disposed in a slipstream of the non-aqueous liquid.
3. The system of claim 1 wherein the water sensor is disposed downstream of the optical particle counter.
4. The system of claim 1 wherein the water sensor is disposed upstream of the optical particle counter.
5. The system of claim 1 wherein the water sensor and the optical particle counter are disposed in parallel in the non-aqueous liquid.
6. The system of claim 1 wherein the water sensor generates a signal indicative of relative saturation water content.

7. The system of claim 1 wherein the water sensor generates a signal indicative of absolute water content.
10. The system of claim 1 wherein the optical particle counter generates a signal indicative of the number of particles in the non-aqueous liquid.
12. The system of claim 1 further comprising a processing circuit operatively coupled to at least one of the water sensor and the optical particle counter.
13. The system of claim 12 wherein the processing circuit receives a signal indicative of the water content from the water sensor.
14. The system of claim 12 wherein the processing circuit receives a signal indicative of the particle count from the optical particle counter.
15. The system of claim 12 wherein the processing circuit signals implications of the water content on the particle count.
16. The system of claim 15 wherein the processing circuit signals implications of the water content on the particle count in accordance with one or more threshold values related to the water content.
18. The system of claim 15 wherein the processing circuit provides an indication of the particle count and an indication of the reliability of the particle count in accordance with the water content.
19. The system of claim 18 wherein the processing circuit provides an indication of the reliability of the particle count in accordance with one or more threshold values related to the water content.

21. The system of claim 12 further comprising a valve arrangement coupled to the processing circuit.
22. The system of claim 21 wherein the processing circuit and the valve arrangement are arranged to direct non-aqueous liquid away from the optical particle counter in accordance with the signal indicative of the water content.
23. The system of claim 22 further comprising a treatment unit coupled to the valve arrangement and arranged to decrease the water content in the non-aqueous liquid.
24. The system of claim 23 wherein the treatment unit includes an outlet coupled to the optical particle counter.
25. The system of claim 21 further comprising a bypass line coupled to the valve arrangement and arranged to bypass the optical particle counter.
26. The system of claim 1 wherein the water sensor and the optical particle counter comprise an integral unit.
27. A method for sampling a non-aqueous liquid comprising:
 - directing the non-aqueous liquid into an optical particle counter and generating a signal indicative of the number of particles present in the non-aqueous liquid and
 - sensing the water content of the non-aqueous liquid.
28. The method of claim 27 wherein the non-aqueous liquid is directed into the optical particle counter after sensing the water content of the non-aqueous liquid.
29. The method of claim 27 wherein the non-aqueous liquid is directed into the optical particle counter before sensing the water content of the non-aqueous liquid.

30. The method of claim 27 wherein the non-aqueous liquid is directed into the optical particle counter at substantially the same time as sensing the water content of the non-aqueous liquid.

33. The method claim 27 further comprising providing an indication of the reliability of the number of particles counted by the optical particle counter.

37. A method for sampling a non-aqueous liquid comprising:

sensing an indication of the water content of the non-aqueous liquid; and
in response to the water content indication either (1) directing the non-aqueous liquid into an optical particle counter and generating a signal indicative of the number of particles in the non-aqueous liquid or (2) directing the non-aqueous liquid away from the optical particle counter.

38. The method of any of claim 37 wherein directing the non-aqueous liquid away from the optical particle counter includes directing the non-aqueous liquid into a treatment unit which decreases the water content of the non-aqueous liquid.

39. The method of claim 38 further comprising directing the non-aqueous liquid from the treatment unit into an optical particle counter.

40. The method of claim 37 wherein directing the non-aqueous liquid away from the optical particle counter includes bypassing the optical particle counter.

41. The method of claim 37 wherein directing the non-aqueous liquid away from the optical particle counter includes directing the non-aqueous liquid into a particulate indicator.

42. The method of claim 41 wherein directing the non-aqueous liquid into a particulate indicator includes passing the non-aqueous liquid through a porous medium and sensing a characteristic of non-aqueous liquid flow through the porous medium.

43. The method of claim 42 wherein sensing a characteristic of non-aqueous liquid flow through the porous medium includes sensing the pressure differential across the porous medium.

44. The method of claim 37 wherein sensing an indication of the water content includes sensing an indication of the relative saturation water content of the non-aqueous liquid.

45. The method of claim 37 wherein sensing an indication of the water content includes sensing an indication of the absolute water content of the non-aqueous liquid.